C3M0900170D

1700V 900mΩ Silicon Carbide Power MOSFET
N-Channel Enhancement Mode

Features

- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- 12V...18V / 0V V_{GS} compatible with most flyback controllers
- Ultra-low drain-gate capacitance
- Qualified to operate under high humidity and high temperature environmental conditions
- Halogen free, RoHS compliant

Benefits

- Smooth switching waveforms
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Increases system switching frequency
- Increases system reliability

Typical Applications

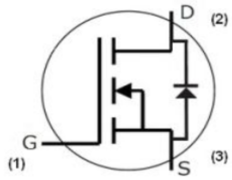
- Auxillary power supplies
- Switch Mode Power Supplies
- High-Voltage capacitive loads

Package

1 2 3

Halogen-Free

RoHS compliant



Orderable Part Number	Package	Marking
C3M0900170D	TO-247-3L	C3M0900170D

Key Parameters

Parameter	Symbol	Min.	Typ.	Max	Unit	Conditions	Note
Drain - Source Voltage	V_{DS}			1700	V	T_C = 25°C	
Maximum Gate - Source Voltage (Transient)	$V_{GS(max)}$	-8		+20		Transient	
Operational Turn-On Gate-Source Voltage	$V_{GS\ op}$		+12...+18			Static	
Operational Turn-Off Gate-Source Voltage	$V_{GS\ op}$		-4...0				
DC Continuous Drain Current	I_D			4.4	A	V_{GS} =15 V, T_C = 25 °C, T_J ≤175 °C	Note 2
				3.3		V_{GS} =15 V, T_C = 100 °C, T_J ≤175°C	
Pulsed Drain Current	I_{DM}			15		t_{Pmax} limited by T_{jmax} V_{GS} = 15V, T_C = 25 °C	Fig. 22
Power Dissipation	P_D			41	W	T_C = 25˚C, T_J = 175 °C	Fig. 20
Operating Junction and Storage Temperature	T_J, T_{stg}			-55 to +175	°C		
Solder Temperature	T_L			260			
Mounting Torque	M_D			1 8.8	Nm lbf-in	M3 or 6-32 screw	

Note (1): Review application Note PRD-04814 for additional details
Note (2): Verified by design

Electrical Characteristics (T_c = 25˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1700			V	V_{GS} = 0 V, I_D = 100 μA	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	3.1	4.2	V	V_{DS} = V_{GS}, I_D = 0.55 mA	Fig. 11
			2.6		V	V_{DS} = V_{GS}, I_D = 0.55 mA, T_J = 175ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	μA	V_{DS} = 1700 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current		10	250	nA	V_{GS} = 15 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance		900	1250	mΩ	V_{GS} = 15 V, I_D = 1.99 A	Fig. 4, 5, 6
			1938			V_{GS} = 15 V, I_D = 1.99 A, T_J = 175ºC	
g_{fs}	Transconductance		1		S	V_{DS}= 20 V, I_{DS}= 1.99 A	Fig. 7
			1			V_{DS}= 20 V, I_{DS}= 1.99 A, T_J = 175ºC	
C_{iss}	Input Capacitance		202		pF	V_{GS} = 0 V, V_{DS} = 0V to 1200 V F = 100 kHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		8				
C_{rss}	Reverse Transfer Capacitance		1.4				
E_{oss}	C_{oss} Stored Energy		8		μJ		Fig. 16
$C_{o(er)}$	Effective Output Capacitance (Energy Related)		10		pF	V_{GS} = 0 V, V_{DS} = 0V to 1200V	Note: 3
$C_{o(tr)}$	Effective Output Capacitance (Time Related)		14		pF		
E_{ON}	Turn-On Switching Energy (External Diode)		154		μJ	V_{DS}= 1200 V, V_{GS}= -4 V/15 V, I_D= 1.99 A, $R_{G(ext)}$ = 2.5 Ω, L= 1707 μH, T_J = 175ºC FWD = External SiC DIODE	Fig. 26, 28
E_{OFF}	Turn Off Switching Energy (External Diode)		15				
$t_{d(on)}$	Turn-On Delay Time		23		ns	V_{DD} = 1200 V, V_{GS} = -4 V/15 V I_D = 1.99 A, $R_{G(ext)}$ = 2.5 Ω, Tj=175⁰C, L=1707 μH Timing relative to V_{DS} Inductive load	Fig. 27, 28
t_r	Rise Time		18				
$t_{d(off)}$	Turn-Off Delay Time		19				
t_f	Fall Time		43				
$R_{G(int)}$	Internal Gate Resistance		31		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		4		nC	V_{DS} = 1200 V, V_{GS} = -4 V/15 V I_D = 1.99 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		4				
Q_g	Total Gate Charge		10				

Note (3): $C_{o(er)}$, a lumped capacitance that gives same stored energy as Coss while Vds is rising from 0 to 1200V
$C_{o(tr)}$, a lumped capacitance that gives same charging time as Coss while Vds is rising from 0 to 1200V

Reverse Diode Characteristics (T_c = 25˚C unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.7		V	V_{GS} = -4 V, I_{SD} = 1 A, T_J = 25 °C	Fig. 8, 9, 10
		4.2		V	V_{GS} = -4 V, I_{SD} = 1 A, T_J = 175 °C	
I_S	Continuous Diode Forward Current	5.8		A	V_{GS} = -4 V, T_C = 25˚C	
I_{SM}	Diode pulse Current		15	A	V_{GS} = -4 V, pulse width t_P limited by T_{jmax}	
t_{rr}	Reverse Recover time	40		ns	V_{GS} = -4 V, I_{SD} = 1.99 A, V_R = 1200 V dif/dt = 546 A/µs, T_J = 25 °C	
Q_{rr}	Reverse Recovery Charge	72		nC		
I_{rrm}	Peak Reverse Recovery Current	3		A		
t_{rr}	Reverse Recover time	40		ns	V_{GS} = -4 V, I_{SD} = 1.99 A, V_R = 1200 V dif/dt = 246 A/µs, T_J = 25 °C	
Q_{rr}	Reverse Recovery Charge	57		nC		
I_{rrm}	Peak Reverse Recovery Current	2		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	2.8	3.7	°C/W		Fig. 21

Typical Performance

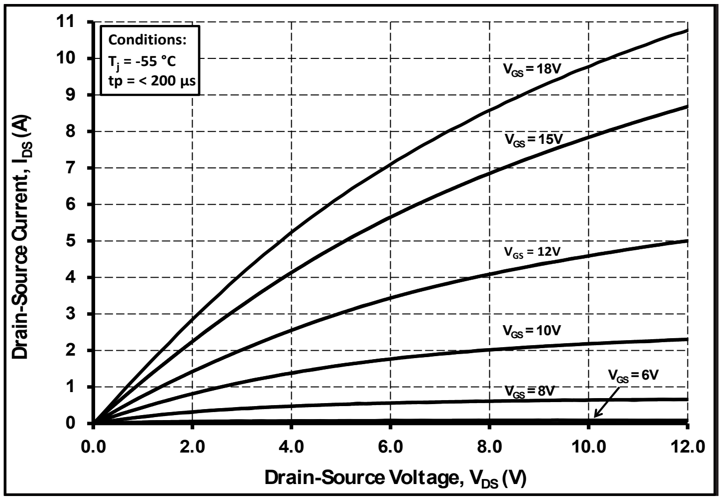


Figure 1. Output Characteristics T_J = -55 °C

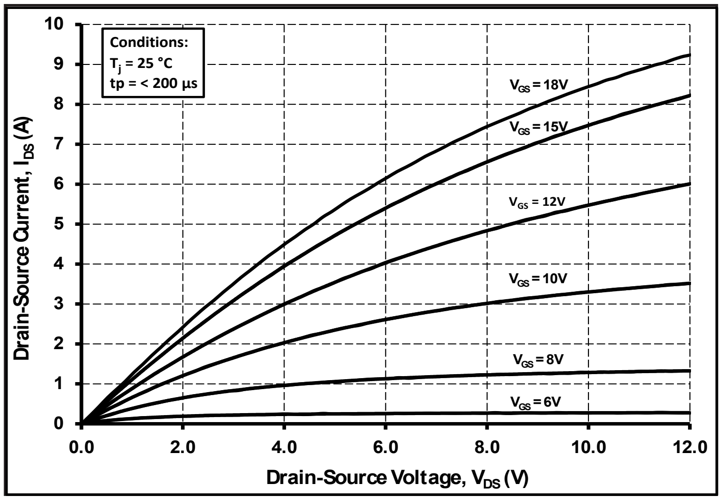


Figure 2. Output Characteristics T_J = 25 °C

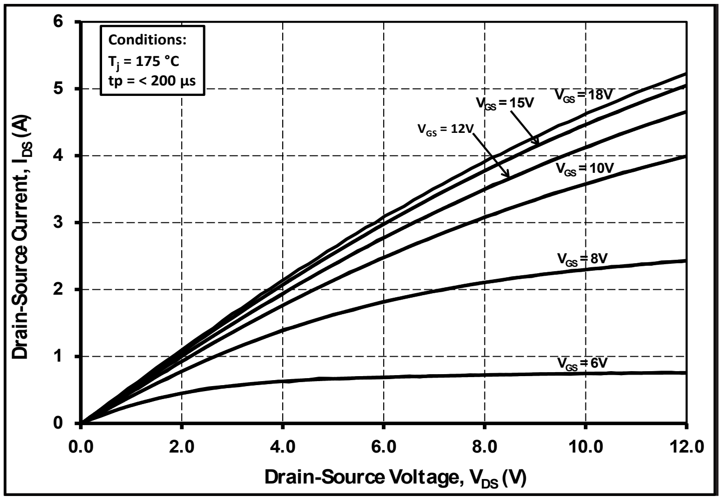


Figure 3. Output Characteristics T_J = 175 °C

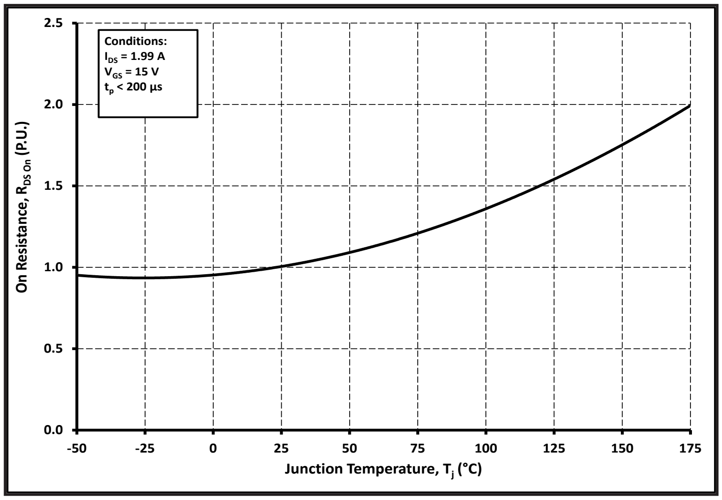


Figure 4. Normalized On-Resistance vs. Temperature

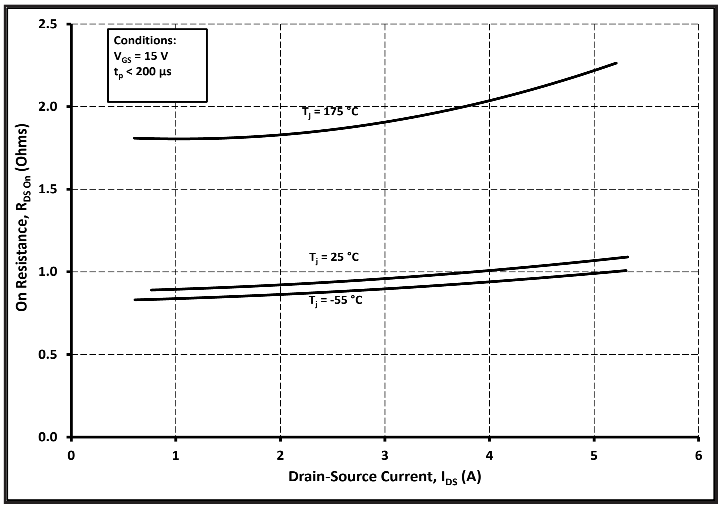


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

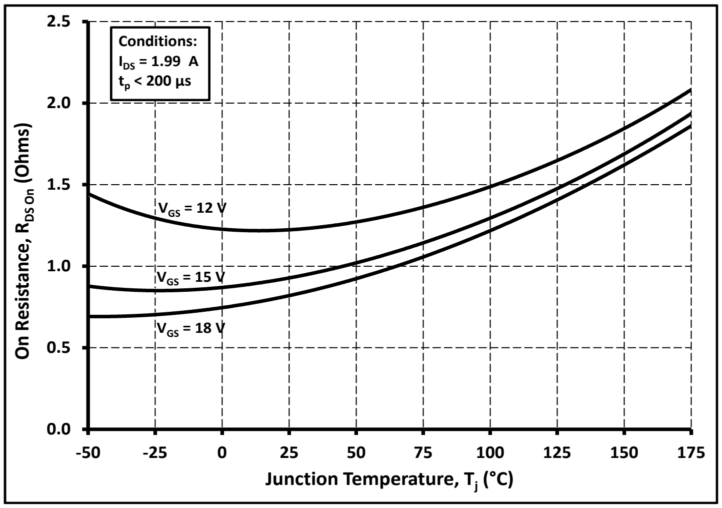


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

Typical Performance

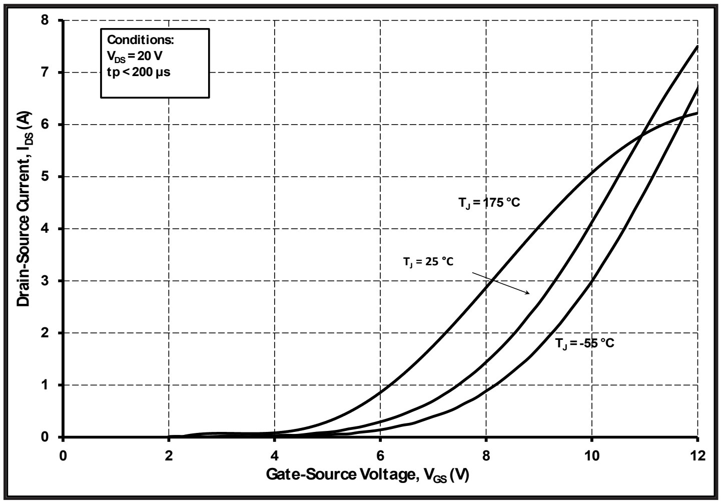


Figure 7. Transfer Characteristic for Various Junction Temperatures

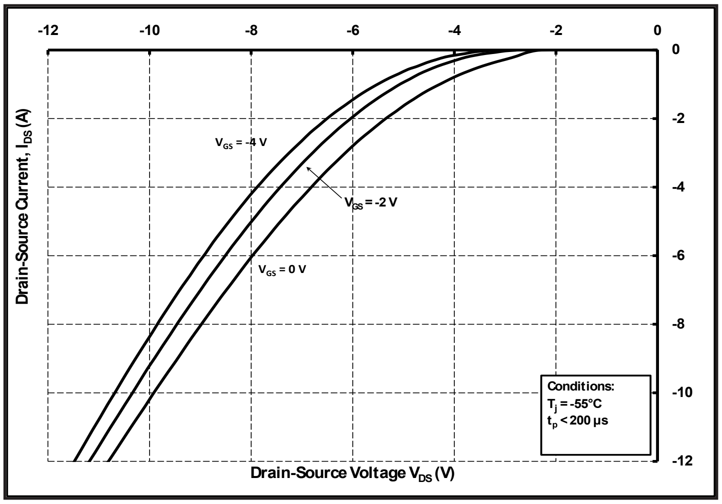


Figure 8. Body Diode Characteristic at -55 °C

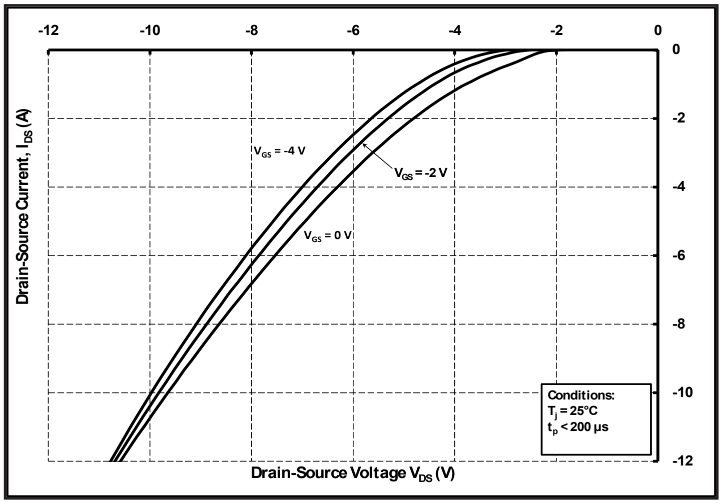


Figure 9. Body Diode Characteristic at 25 °C

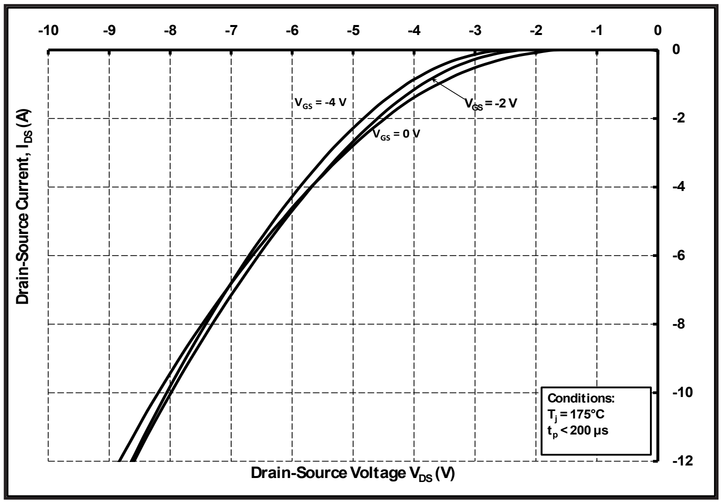


Figure 10. Body Diode Characteristic at 175 °C

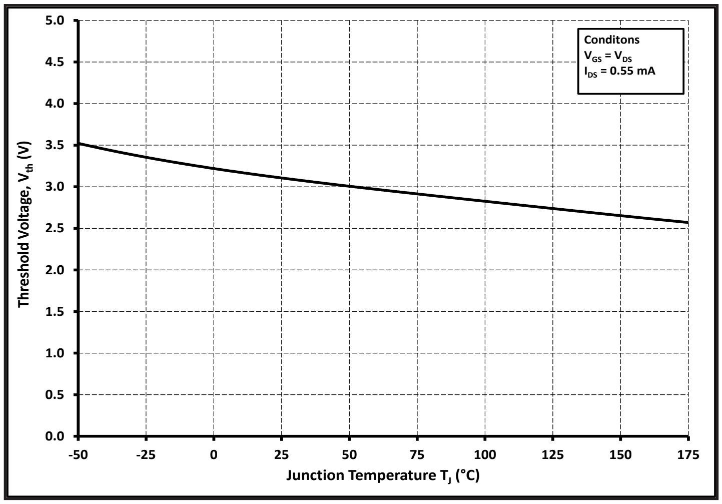


Figure 11. Threshold Voltage vs. Temperature

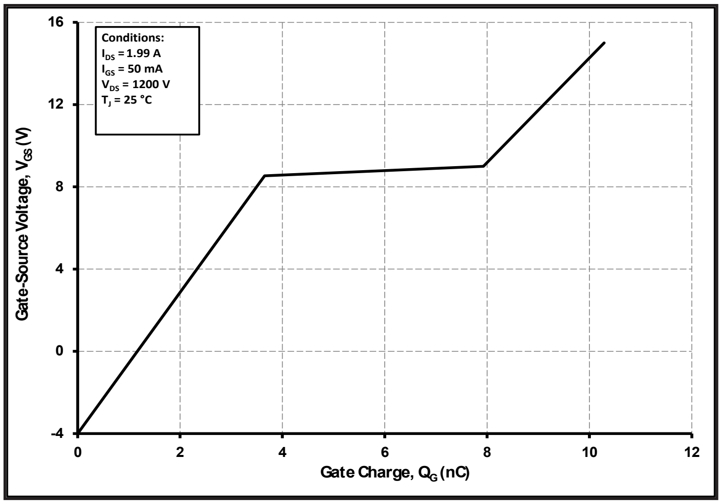


Figure 12. Gate Charge Characteristics

Typical Performance

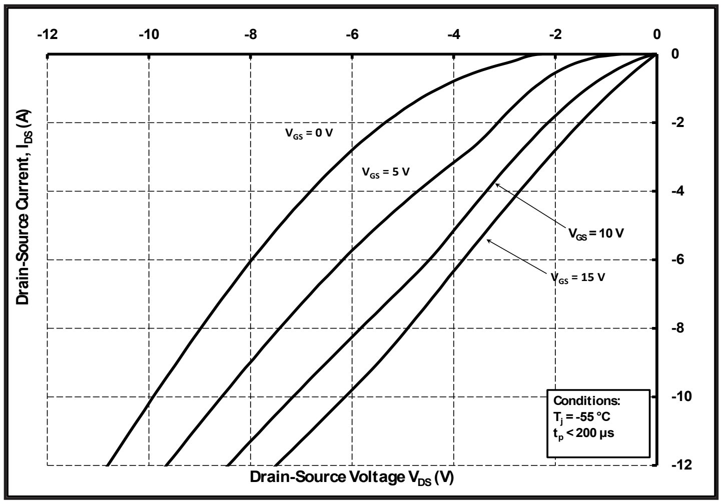


Figure 13. 3rd Quadrant Characteristic at -55 °C

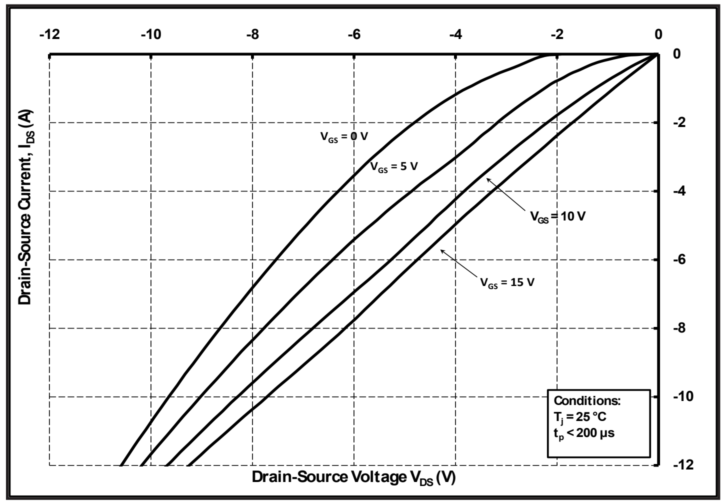


Figure 14. 3rd Quadrant Characteristic at 25 °C

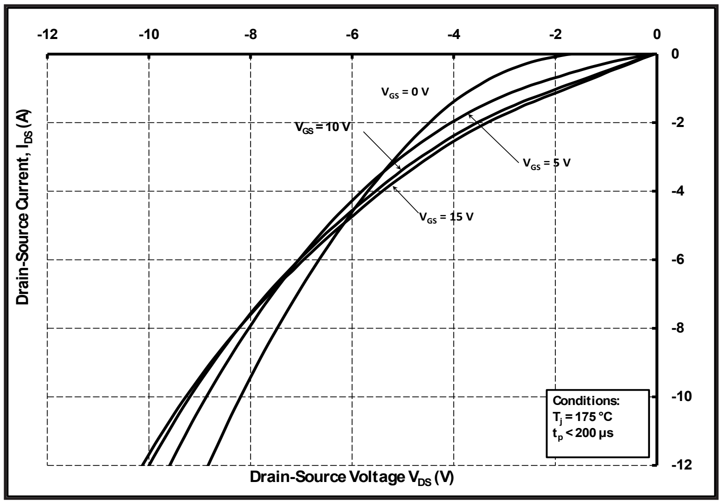


Figure 15. 3rd Quadrant Characteristic at 175 °C

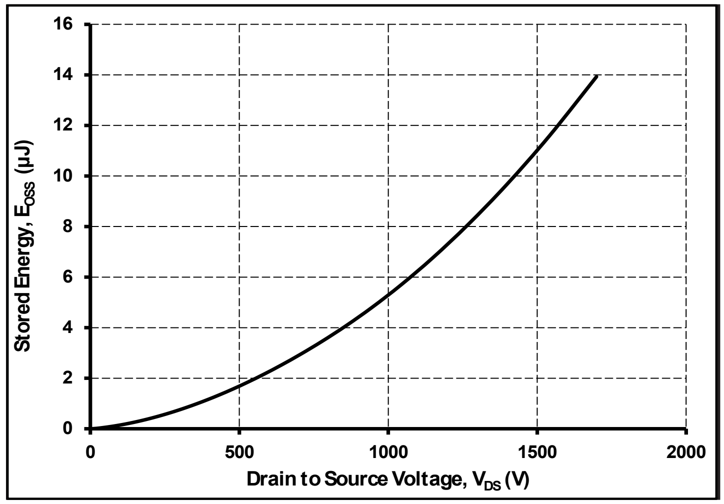


Figure 16. Output Capacitor Stored Energy

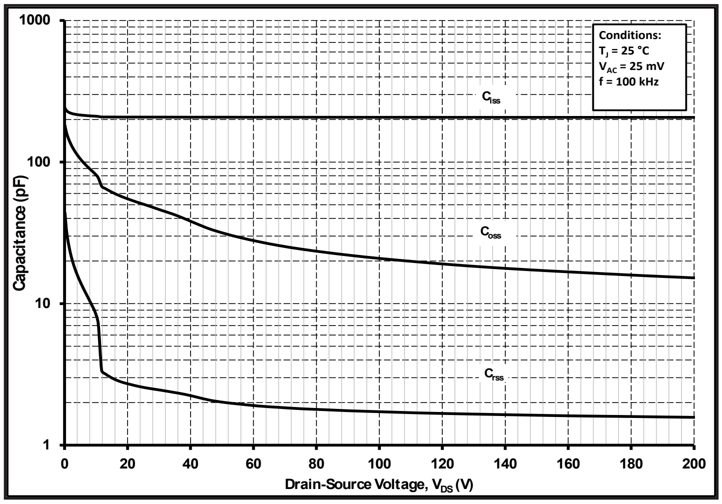


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

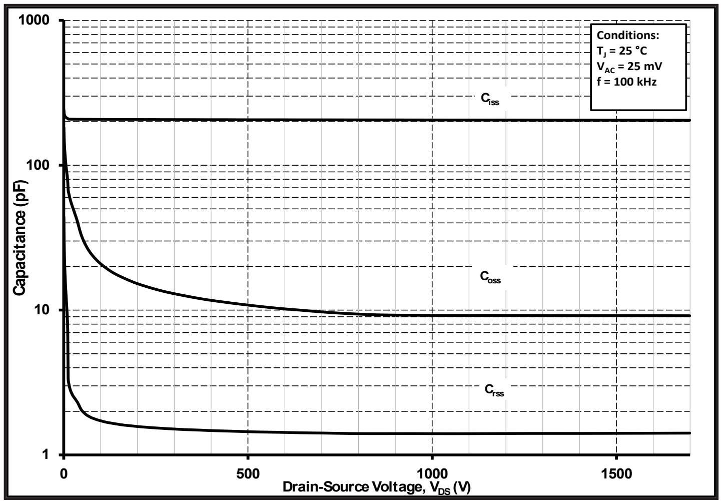


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1700V)

Typical Performance

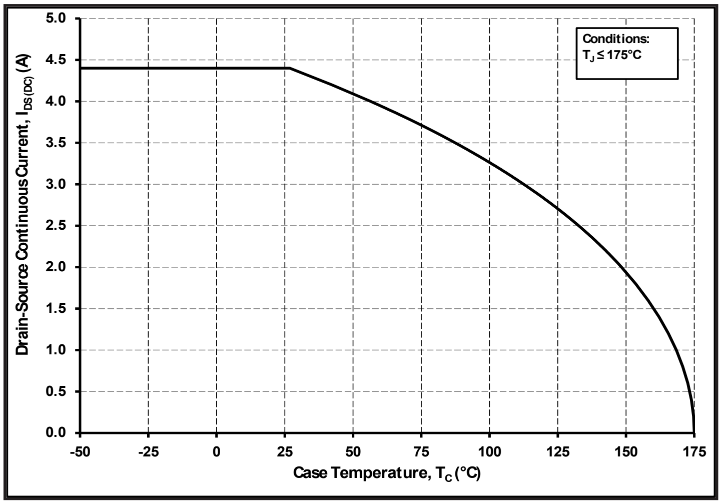


Figure 19. Continuous Drain Current Derating vs. Case Temperature

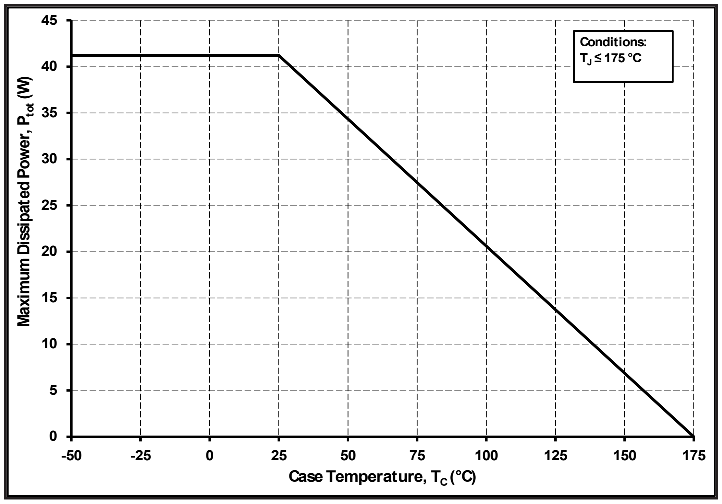


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

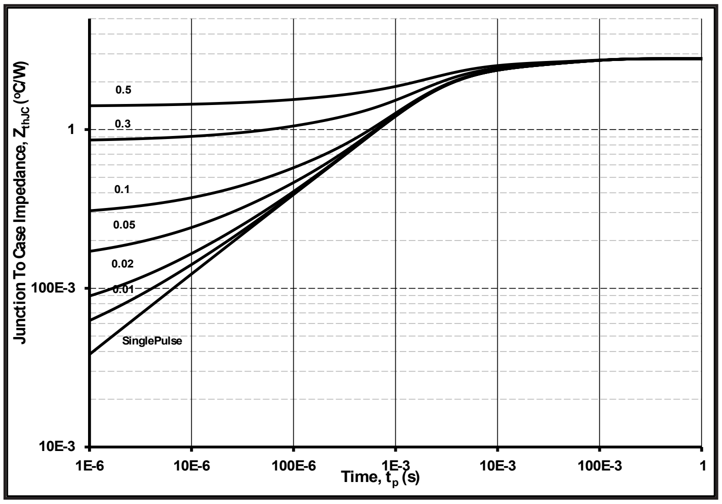


Figure 21. Transient Thermal Impedance (Junction - Case)

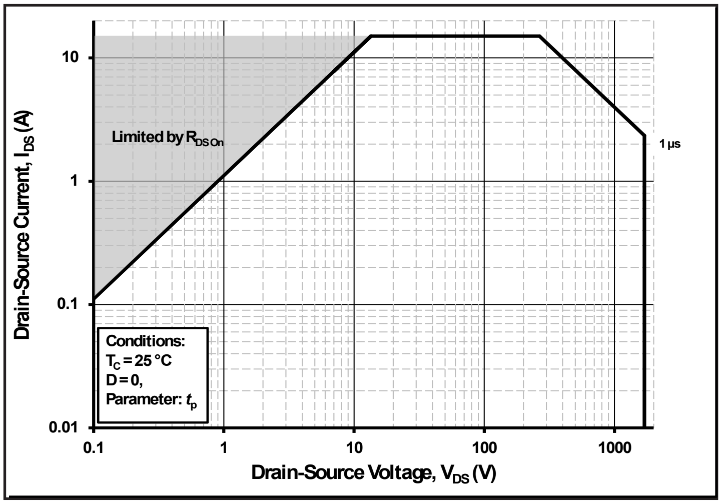


Figure 22. Safe Operating Area

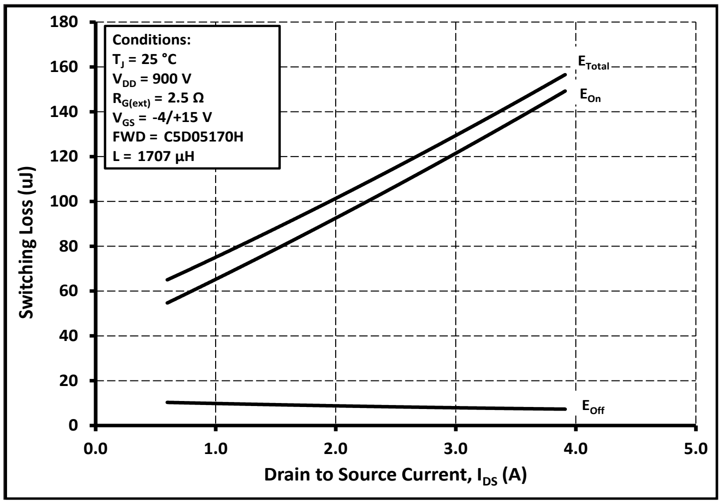


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 900V)

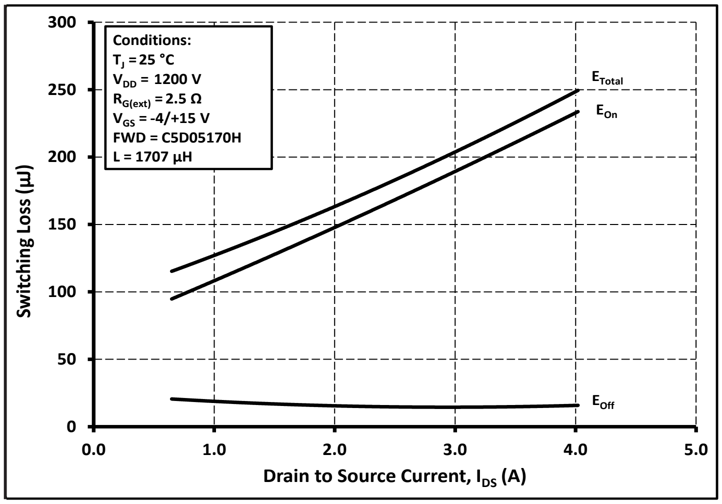


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 1200V)

Typical Performance

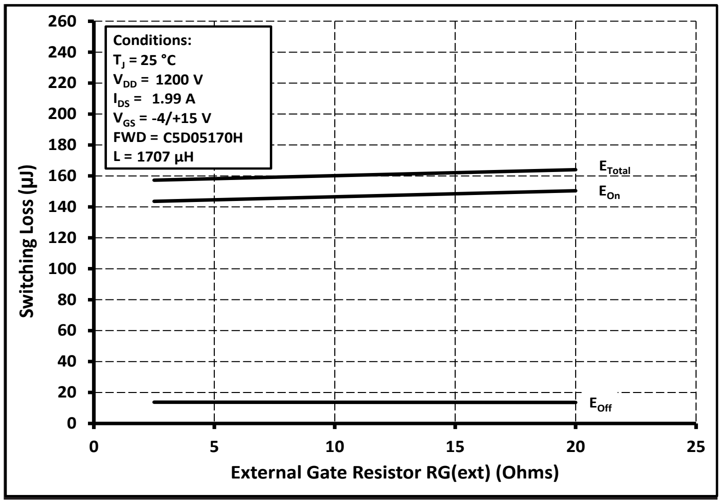


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

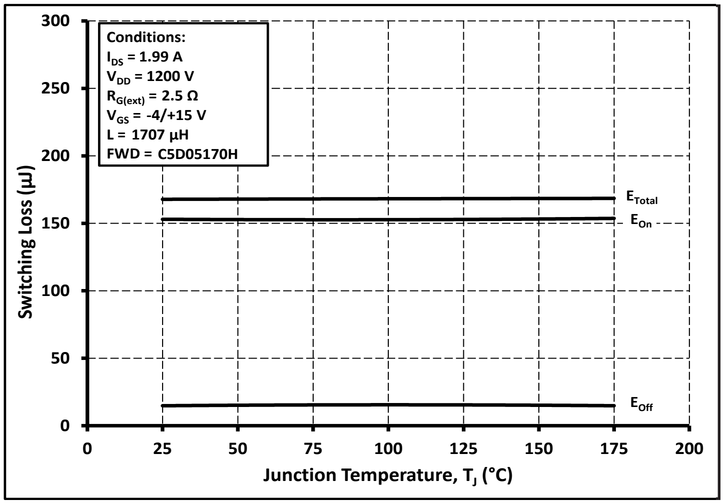


Figure 26. Clamped Inductive Switching Energy vs. Temperature

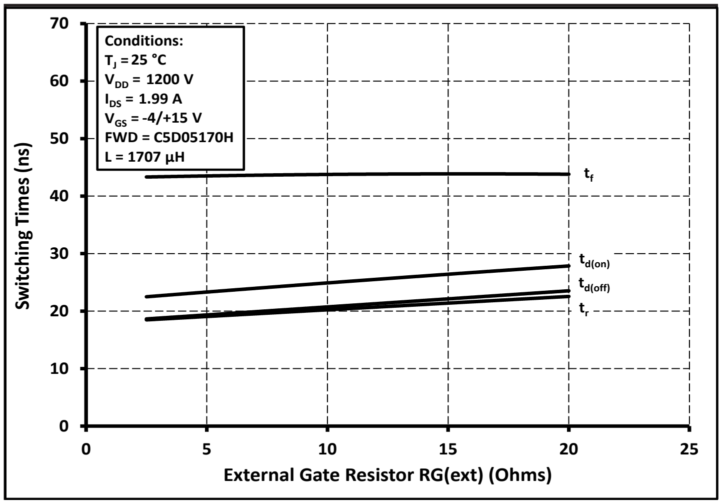


Figure 27. Switching Times vs. $R_{G(ext)}$

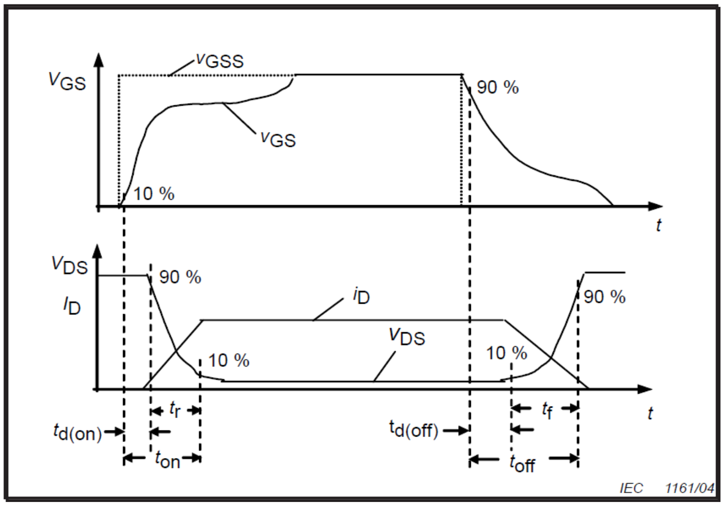


Figure 28. Switching Times Definition

Test Circuit Schematic

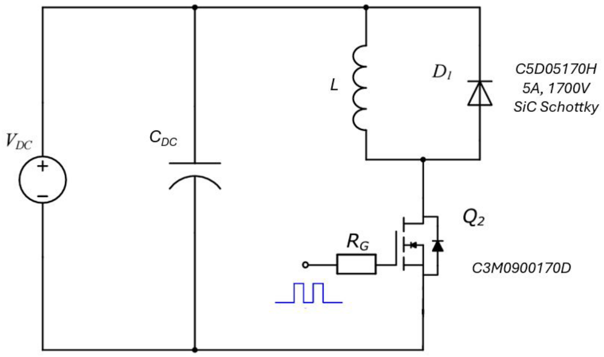
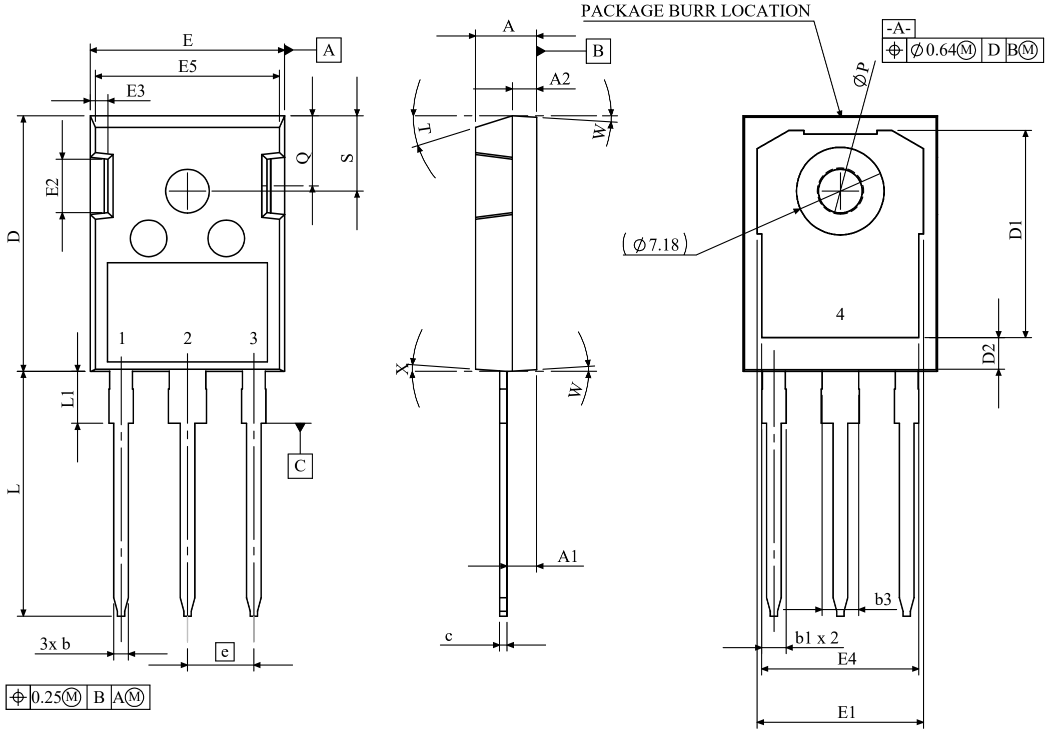


Figure 29. Clamped Inductive Switching Waveform Test Circuit

Package Dimensions



SYMBOL	MIN (mm)	MAX (mm)
A	4.83	5.21
A1	2.27	2.52
A2	1.91	2.16
b	1.07	1.33
b1	1.91	2.41
b3	2.87	3.38
c	0.55	0.74
D	20.75	21.05
D1	16	17.4
D2	2.86	3.26
E	15.75	16.13
E1	13.5	14.55
E2	3.68	5.1
E3	1	1.9
E4	12.38	13.43
E5	14.65	15.05
e	5.44 BSC	
L	19.73	20.48
L1	3.97	4.69
ØP	3.18	4.06
Q	5.42	5.96
S	5.85	6.49
T	17.5° REF.	
W	3.5° REF.	
X	4° REF.	

1	GATE
2	DRAIN
3	SOURCE
4	DRAIN

NOTES:
1. ALL METAL SURFACES ARE TIN PLATED (MATTE), EXCEPT AREA OF CUT.
2. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE LISTED IN MILLIMETERS. ANGLES ARE IN DEGREES.
4. BURR OR MOLD FLASH SIZE (0.5 mm) IS NOT INCLUDED IN THE DIMENSIONS

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TITLE: PACKAGE OUTLINE DRAWING: TO-247-3L(MOSFET)

Date: 3/4/24

REVISION NO. 02 | A4

PRD 05964 | SCALE:1:1 | SHEET 1 OF 1

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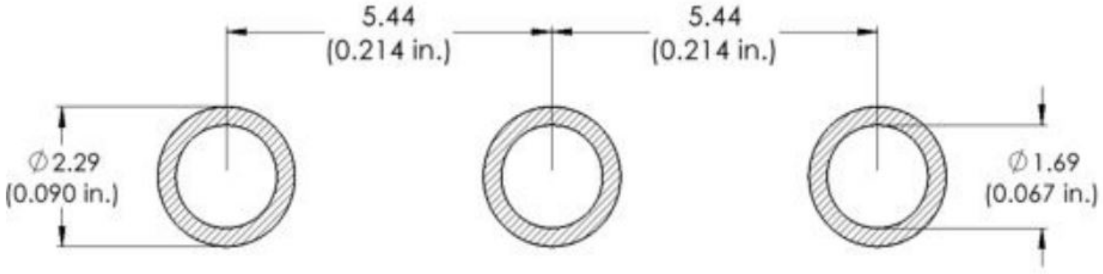
Recommended Solder Pad Layout

All dimensions in mm



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Revision history

Document Version	Date of release	Descriptiion of changes
1.0	December-2024	Initial datasheet
2.0	February-2025	Updated with latest Characterization data

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